

A BIOLOGICAL SURVEY OF GARDEN ISLAND, WESTERN AUSTRALIA: 2. TERRESTRIAL MAMMALS.

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ABSTRACT

The Tammar *Macropus eugenii* and two introduced species, the House Mouse *Mus domesticus* and Feral Cat *Felis catus*, were the only terrestrial mammals recorded during a biological survey of Garden Island in 1991–92. Tammars were widespread and abundant in all habitats. A comparison of our Tammar counts with those obtained in the 1970s and 1980s indicated an increase in numbers. On the basis of diet and foraging range, we suggest that probably three groups of Tammars exist – the “urban” animals at the Naval Base, a “roadside” group and “native” Tammars confined to the natural vegetation away from the Base, roads and firebreaks.

Garden Island has few introduced mammals compared to the mainland. Sheep and Rabbits have been removed and Feral Cat numbers are low. However, the House Mouse was found on all sampling sites and may now play an important role in the ecosystem of the island.

INTRODUCTION

A biological survey of Garden Island was undertaken during 1991 and 1992. A short history of the European settlement of the island, a description of the vegetation and the findings of a bird and reptile census are given in Brooker 1992 and Brooker *et al.* (this volume). This paper deals with observations of the terrestrial mammals, with special reference to the only native species, the Tammar *Macropus eugenii*.

Tammars are small (3–7 kg) wallabies which were once widespread in dense thickets in south-western Australia and coastal South Australia (Poole *et al.* 1991). Their

distribution has contracted considerably since white settlement (Perry 1973). In Western Australia, some isolated populations still persist on the mainland and five Western Australian island populations are extant, with that on Garden Island being the largest.

METHODS

Tammars and other nocturnal terrestrial vertebrates were counted by spotlight on an 18.1 km transect (see Figure 1) over 14 nights.

The survey team consisted of a driver and two observers with 100 watt spotlights, recording the total



Figure 1. Map of Garden Island showing sections (numbered as in Table I) of road transect on which Tammar counts were made.

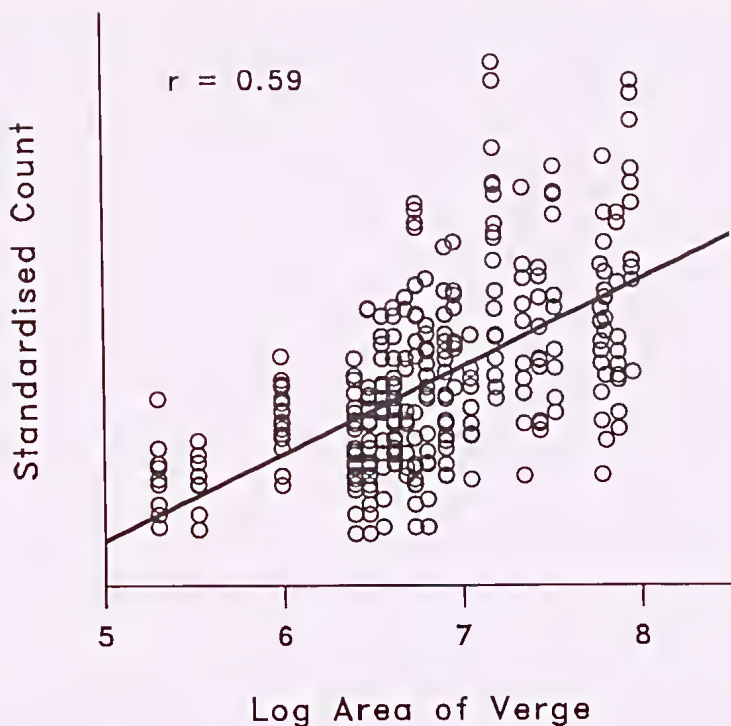


Figure 2. Relationship between the numbers of Tammars (plotted as residuals from the regression of season on Tammars number, thereby producing counts "standardised" for seasonal effects) and the log area of the verge (m^2).

numbers of Tammars seen on each 0.5 km section of the transect. Separate counts were made of the two large grassed areas on the Naval Base, near the Oval and the Z Force Memorial. The width of the road verge was measured and the proportions of each different vegetation community present in each section was obtained from a vegetation map (W. McArthur, unpubl.) Ten pitfall and 10 Elliott traps were set in each of twenty 100m^2 quadrats which sampled the major vegetation communities present on the island. The traps were operated over four nights, first in April 1991

and again in November 1991. A full description of the quadrats is given by Brooker (1992).

RESULTS

Tammars Macropus eugenii

The numbers of Tammars counted during 14 spotlight transects are shown in Table 1. A subset of these data (8 counts, two replicates for each census month) were analysed for sectional and seasonal effects. Omitted from the analysis were the counts made in April 1991 (missing data), 25 November (low temp-

Table 1. Numbers of Tammars counted on 36 Sections of Transect (see Figure 1) 8 March 1991 – 14 April 1992 (Time = WST; Wind = Beaufort Scale, Cloud and Moon estimated in eighths; NR = not recorded).

Section	8.4.91	9.4.91	10.4.91	11.4.91	22.7.91	23.7.91	25.11.91
1	2	5	2	2	3	0	5
2	3	4	0	2	4	2	7
3	5	3	0	4	10	1	11
4	28	9	15	18	6	12	17
5	9	8	12	15	11	3	16
6	11	3	7	9	10	4	8
7	13	8	11	26	14	1	25
8	20	24	15	24	14	6	10
9	15	19	31	33	15	15	24
10	12	34	16	28	45	25	49
11	20	10	3	14	36	19	63
12	44	3	9	23	49	7	45
13	3	4	3	4	19	7	6
14	17	10	5	8	5	2	4
15	9	5	2	4	19	10	14
16	21	9	11	9	20	6	8
17	32	12	10	16	4	5	1
18	8	11	6	4	19	6	9
19	4	10	5	3	20	22	9
20	9	7	4	4	13	13	3
21	45	8	10	13	9	6	9
22	0	5	2	3	11	7	5
23	1	2	3	0	4	3	5
24	3	3	3	0	6	3	4
25	14	2	5	6	8	4	2
26	11	1	6	2	3	2	2
27	6	3	9	8	13	9	5
28	2	2	2	3	7	2	1
29 Second Head Rd	11	5	9	6	7	11	13
30 Point Atwick Rd	33	2	8	5	11	22	24
31 Gilbert Point Rd	17	9	2	9	13	23	14
32 Denham Rd East	NR	NR	NR	NR	16	7	39
33 Denham Rd West	NR	NR	NR	NR	29	4	20
Total Denham Rd	55	13	20	21	45	11	59
34 Oval	220	24	120	175	298	138	376
35 Beagle Rd	21	0	0	13	9	18	9
36 Z-Force	60	15	37	27	24	3	24
Time	20:08	20:00	21:55	22:10	18:15	18:18	20:45
Wind	1	3	3	1	1	3	3
Temperature	20	17	16	14	14	16	16
Rain		Yes	Yes				
Cloud	1	5	2	1	4	3	6
Moon	0	0	0	0	0	7	0

Table 1 (cont.) (26 November 1991 – 14 April 1992)

Section	26.11.91	27.11.91	28.11.91	28.1.92	29.1.92	13.4.92	14.4.92
1	7	7	4	2	2	1	0
2	2	1	5	6	0	0	0
3	16	13	19	10	10	14	14
4	9	9	8	18	10	23	11
5	5	6	1	11	7	2	7
6	4	9	13	3	5	1	1
7	14	12	22	6	13	4	2
8	13	12	15	13	10	7	5
9	25	25	28	12	7	13	20
10	53	69	77	35	24	68	45
11	44	45	29	20	12	32	37
12	37	44	49	11	9	18	7
13	3	1	19	5	6	6	7
14	1	13	13	4	8	10	4
15	8	6	25	5	3	5	9
16	8	4	7	5	6	7	6
17	4	7	4	1	6	5	2
18	11	5	7	4	7	3	2
19	6	4	10	4	10	5	10
20	15	9	6	4	2	14	5
21	4	4	14	21	17	25	16
22	7	5	4	2	20	0	0
23	NR	9	9	1	0	0	2
24	NR	3	12	7	1	1	3
25	NR	10	4	4	4	1	4
26	NR	4	6	1	12	2	2
27	NR	4	3	4	4	3	5
28	2	1	1	0	3	1	2
29 Second Head Rd	12	16	20	31	33	22	12
30 Point Atwick Rd	23	21	28	22	15	48	35
31 Gilbert Point Rd	45	42	49	6	7	14	8
32 Denham Rd East	57	53	64	23	20	20	27
33 Denham Rd West	15	28	23	1	8	11	14
Total Denham Rd	72	81	87	24	28	31	41
34 Oval	350	376	345	230	132	194	174
35 Beagle Rd	4	9	18	12	1	25	16
36 Z-Force	23	23	20	11	19	15	4
Time	20:45	21:00	20:45	19:55	20:20	18:55	18:30
Wind	3	2	2	1	1	2	2
Temp.	18	20	21	24	25	21	21
Rain							
Cloud	0	1	0	1	0	4	1
Moon	0	0	0	0	0	4	5

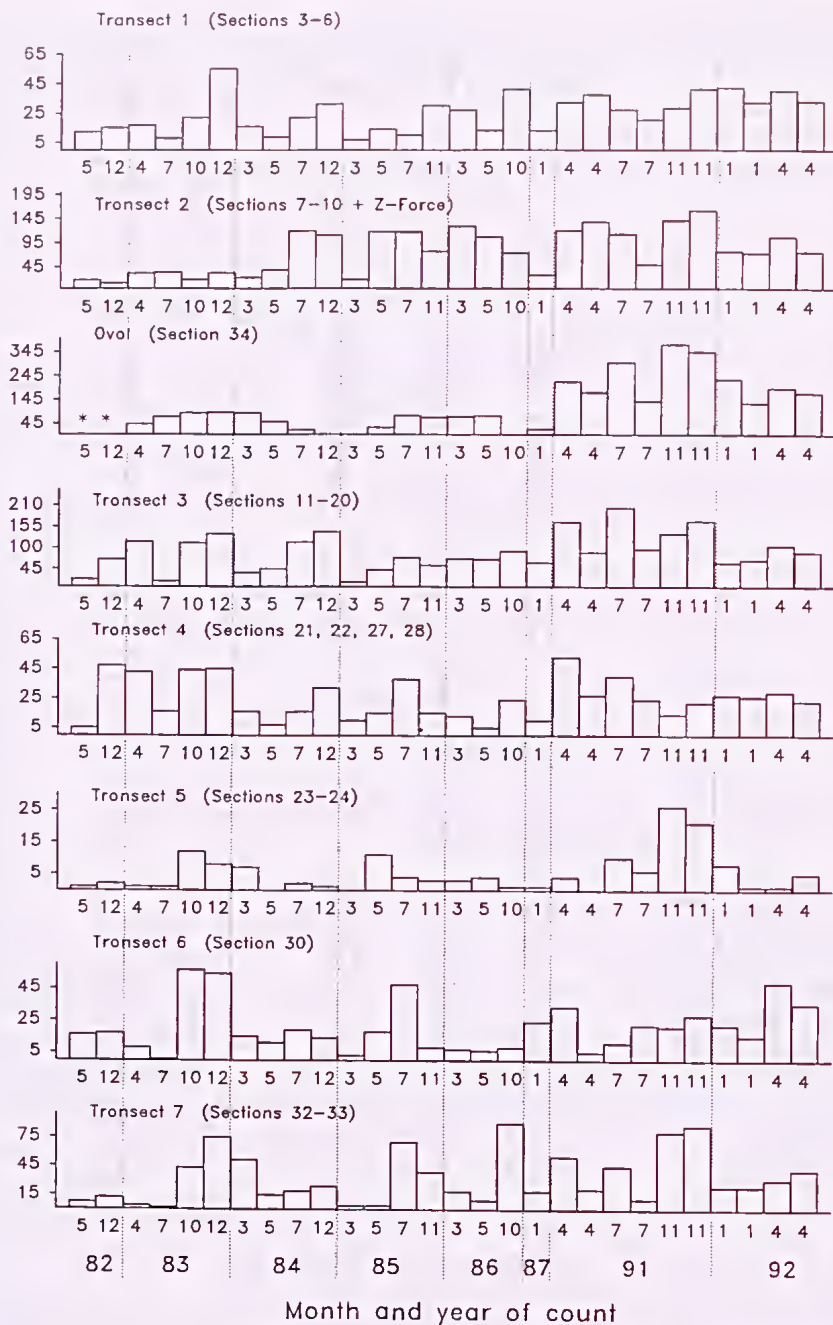


Figure 3. Numbers of Tammars counted by UWA (18 counts, 1982-87) and present survey (10 counts, 1991-92). The UWA data were obtained on transects which approximate one or more of the Sections in this study (* = not counted).

erature) and 26 November (missing data).

An analysis of variance of the transformed counts ($\sqrt{x + 0.5}$) showed no significance difference between replicates ($F_{1,234} = 1.26$; n.s.), but highly significant differences among sections of transect ($F_{33,234} = 12.09$; $P < 0.001$) and among seasons ($F_{3,234} = 10.92$; $P < 0.001$). The lowest counts were in July and the highest in November 1991.

The mean counts for each section were examined also for sectional effects such as verge area (sections of approximately equal length varied in width of verge) and vegetation type. We found a significant positive relationship between the Tammar counts and the verge area (see Figure 2). In addition, the counts were positively correlated with the presence of *Melaleuca huegelii* but showed no relation to the presence/absence of *Acacia rostellifera*, *M. lanceolata* or *Callitris preissii*.

The count data from this study were compared with the numbers obtained by the University of Western Australia (UWA) in the 1980s (Figure 3; data supplied by L. Schmidt). The transect averages from the road counts were from 28% (Transect 5) to 240% (Transect 7) greater than the UWA counts.

Similarly, the numbers of Tammars on Transect 1, which was counted by UWA in 1973–4 (data from Anon 1974), averaged 5.4 ± 4.8 , compared to 20.1 ± 12.7 in 1982–7 (UWA, $N=18$) and 33.2 ± 7.3 in 1991–2 (present survey, $N=10$). The numbers seen on the Oval were also considerably higher in 1991 and 1992 than had been reported previously. This could have been due to changes in

the management of the Oval fence which did not exclude animals at the time of the 1991–2 survey.

House Mouse *Mus domesticus*

The introduced House Mouse was the most numerous vertebrate caught in traps during the survey (Brooker 1992). They were found on all sites in autumn (mean number per site 3.4 ± 2.1) and on 14 of the 20 sites in spring (1.5 ± 1.6) (see Table 2).

Black Rat *Rattus rattus*

According to Anon (1979), "non-native" rats have established breeding populations on the island, although none were trapped during this survey. Nevertheless, they have been seen by Naval Staff at the mainland end of the Causeway and an immature Black Rat *Rattus rattus* was trapped there in May 1991.

Feral Cat *Felis catus*

Only one Cat was seen during the survey – on Section 32 (Denham Road) on the night of 28 January 1992. This suggests that control measures for this species have been effective, as 12 individuals were seen on 13 spotlight transects during 1973–74 (Anon 1974).

DISCUSSION

The Tammar and two introduced species, the House Mouse and Feral Cat, were the only terrestrial species of mammals present.

Tammars were found in all surveyed vegetation types on the island, although most frequently in *Acacia rostellifera* – *Melaleuca huegelii* Scrub. They were least common in

Table 2. Numbers of House Mice captured in Pitfall (P) and Elliott (E) Traps, Autumn and Spring 1991.

SITE	Number captured					
	P	Autumn E	Total	P	Spring E	Total
1	0	1	1	0	0	0
2	1	1	2	0	0	0
3	2	4	6	2	0	2
4	0	5	5	0	0	0
5	1	1	2	0	0	0
6	3	0	3	3	0	3
7	0	1	1	1	0	1
8	2	4	6	2	3	5
9	0	4	4	1	0	1
10	3	3	6	1	0	1
11	1	4	5	1	0	1
12	1	0	1	1	0	1
13	2	3	5	0	2	2
14	1	1	2	0	4	4
19	1	0	1	0	0	0
20	1	2	3	1	0	1
21	1	2	3	0	0	0
22	1	0	1	3	2	5
24	3	0	3	1	1	2
26	4	4	8	1	0	1
Sum	28	40	68	18	12	30
Mean	1.4	2.0	3.4	0.9	0.6	1.5
SD	1.1	1.7	2.1	1.0	1.2	1.6
per 100 TN*	3.5	5.0		2.2	1.5	

* TN = trap nights

south-west coastal areas. The number counted was highest during the November survey, coinciding with the period when most young had left the pouch (Inns 1980, Bradshaw 1988).

Compared to surveys undertaken in the 1970s and 1980s by the University of Western Australia, the numbers of Tammars counted in the present survey were higher and the numbers on the Oval were considerably higher than before. In fact the counts suggest that Tammars may now be more

abundant than in the 1970s and 1980s, although this conclusion must be qualified by the knowledge that differences in spotlighting techniques and observers and possible changes in the extent, composition and management of the road verge and lawn areas could account for the differences in numbers.

The food resources (mainly exotic plants) provided along fire breaks, roads and facilities and the invasion of other exotics into the natural vegetation could be responsible for

any increase in the numbers of Tammars. Bell *et al.* (1987) found that their preferred diet included *Asphodelus fistulosus*, which is found on most verges and fire breaks, together with another onion weed *Trachyandra divaricata*. Also eaten was the Asparagus Fern *Asparagus asparagoides* which is extending its range into the native vegetation. The lawn areas of the Oval, at the Base and along the roads consist mainly of Couch Grass *Cynodon dactylon*, which is grazed extensively by the Tammars. Thus the Tammars on Garden Island could be divided by diet into three groups – the “urban” animals at the Naval Base, the “roadside” animals whose home ranges include areas of road verge and the “native” animals in natural vegetation away from the Base and roads.

Garden Island has few introduced mammals compared to the mainland. Sheep and rabbits have been removed and Feral Cat numbers are low. Only the House Mouse was numerous, being found on all sites. Mice may therefore contribute to the abundance of Carpet Pythons *Morelia spilota* and Tiger Snakes *Notechis scutatus* on the island, since it is likely that mice feature prominently in their diets. The presence of Black Rats on the Causeway is of concern, as an infestation of the island could have a serious impact, particularly on low-nesting birds such as Fairy Terns *Sterna nereis* and Brush Bronzewings *Phaps chalcoptera*.

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